MECHATRONICS BOOK SERIES

CONTROL AND INTELLIGENT SYSTEMS

Momoh Jimoh E. Salami
Abiodun Musa Aibinu
Yasir Mohd Mustafah

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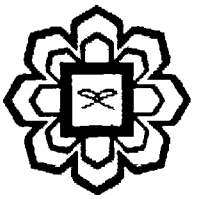

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Chapter 22
Intelligent Air-conditioning System

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22.1 Introduction

In both commercial and private buildings it is common to control room temperature with single heating, ventilating, and air-conditioning (HVAC) unit and controller. Systems configured this way are most commonly controlled with a single sensor in one of the rooms. The controller gets the temperature reading from one of the sensors, and supplies heating or cooling to all other parts of the rooms proportionally.
This method assumes that all parts of the rooms have the same load all the time, and therefore the same temperature throughout. This is often a poor assumption, which leads to discomfort and more energy consumption than necessary. The reason for controlling room temperature with a single controller and a single sensor is cost.
It is expensive to install a separate HVAC unit and controller for each part of room. It is also expensive to install temperature sensors in every corner of the room, primarily because of the cost of running wire to the sensors. New technology, particularly wireless sensor technology, offers the opportunity to significantly reduce the cost of sensors such as those used to control space temperature in commercial buildings and private homes. However, the actuation parts of the system will still be expensive for the foreseeable future.
In this paper, investigation on the potential benefit of replacing a single temperature sensor used to control temperature in a room with a sensor network that provides one sensor per area of the room.
However, the actuations do not change. There is still just one controller and one HVAC unit for the room. To our knowledge, the energy and comfort implications of this problem have not been analyzed. Most multiple sensor control problems have focused on fault tolerance [1] or multi-target problems [2, 3].
The problem addressed in this paper is like a multi-target problem where not all of the targets can be satisfied since there is one actuator. The focus of the paper is on how to make use of the additional information available from the network of sensors, and an evaluation of how different methods of using the information affect energy performance and thermal comfort.
In this paper a system to analyze the effectiveness of multiple-sensor configuration is laid out. The system is designed to be implemented by any air-conditioning system that has integrated vane system to direct air-flows from the air-conditioner[6]. It can be aimed at optimizing comfort, or minimizing energy consumption subject to constraints on comfort.
The next section describes the set-up of the experimental system after a brief statement about the objectives of this project. The subsequent section describes the hardware implementation of the system. In the next section the results of the experiment and its analysis are presented.

This project aims at developing and implementing an intelligent air-conditioning which is effective as well as reliable to meet human comfort. The emphasis during the development process will be laid on the efficiency of the system to minimize the time the actuator is switched on. The human comfort for this part of the project will be to ensure an even